



# Alteration of Terrain & Antidegradation

---

Alteration of Terrain Rules Revision Workshops  
New Hampshire Department of Environmental  
Services

Gregg Comstock, P.E. and Jillian McCarthy,  
Watershed Management Bureau



# Antidegradation

---

## ○ **IMPORTANT:**

- **11/10/08: DES plans to postpone inclusion of most of the Antidegradation section currently in the proposed AoT rules for about 1 year**
- Need time to work with stakeholders on the Antidegradation section and implementation guidance (6 +/- months).
- **Purpose of this presentation is to introduce you to Antidegradation , discuss the provisions we had proposed, and how we are addressing antidegradation for projects requiring Section 401 Water Quality Certifications (WQC).**



# WHAT IS DEGRADATION?

---

**GOOD** Water Quality



**Add  
Pollutants** →

**DEGRADATION**

**POOR**



# Antidegradation Sections in AoT Rules

(most will be removed from regulations for now)

---

- 1504.06  
Antidegradation Plans; Deed Restrictions
- 1504.13  
Calculations of Percent Effective Impervious Cover  
and Percent Undisturbed Cover
- 1507.01  
Water Quality Degradation Prohibited (general  
statement that will likely stay in regulations)
- 1507.07  
Antidegradation Requirements



## Why these sections were proposed

---


- Goal of Alteration of Terrain (AoT) regulations includes protection of surface waters
- Inclusion of Antidegradation Provisions of the NH Surface Water Quality Standards (Env-Wq 1708) is necessary to achieve this goal



# Existing Antidegradation Provisions

---

- To protect and maintain existing instream water uses (e.g., fishing, swimming, public water supply) and the level of water quality necessary to protect those uses.
  - Env-Wq 1708
  - Statutory authority RSA 485-A
- Antidegradation provisions
  - have been in Env-Wq 1700 for over 17 years – **NOT NEW!**
  - applies to any activity that will increase pollutants or significantly change hydrology in surface waters
    - (applies to stormwater from development projects)
- **No one can degrade a surface water unless provisions of Env-Wq 1708 are met**



## Steps Needed to Justify Degradation per Env-Wq 1708

---

- Determine existing water quality (monitoring)
- Conduct modeling to predict instream water quality with development
- Investigate alternatives
- Provide important social-economic justification
- Provide opportunity for public comment
- DES then makes decision
- Process could take months/years with no guarantee degradation will be allowed
- **To avoid process, don't degrade (i.e., show no additional loading)**



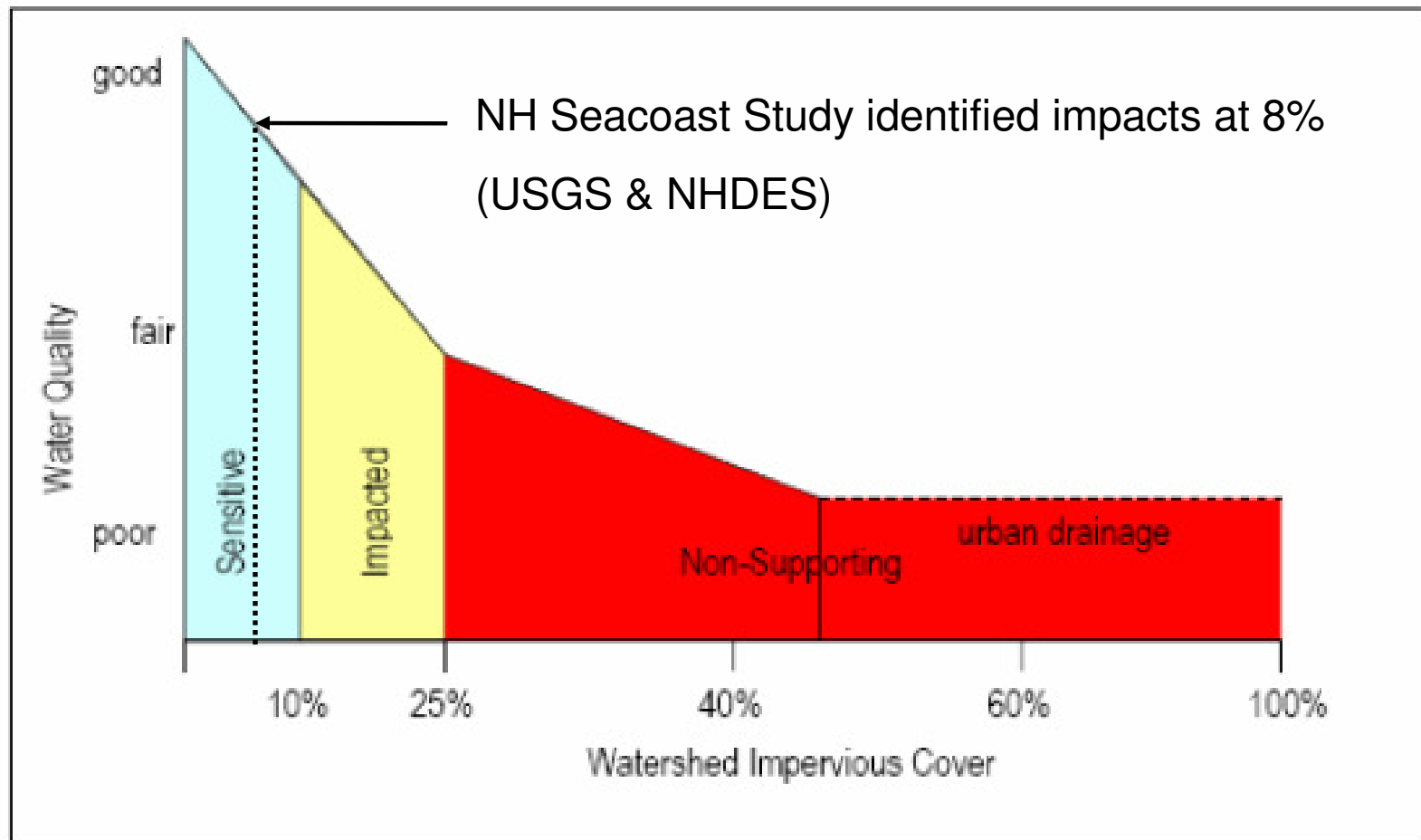
# Why Antidegradation Provisions are Needed? THE FACTS

---

- It's the LAW!
  - RSA 485-A & Env-Wq 1700
- Science / Data indicate current AoT stormwater regulations aren't always adequate to meet water quality standards
  - Lots of research available which indicates degradation of aquatic life when % Effective Impervious Cover (EIC) exceeds ~ 10%
    - Center for Watershed Protection
    - USGS/DES Study on the Seacoast
    - Impervious cover TMDLs in Connecticut and Maine
  - Stormwater pollutant concentrations vary greatly depending on
    - Area developed
    - Land Use (Residential, Commercial, Forest, etc)
    - % Effective Impervious Cover (EIC)
    - BMP type (removal efficiencies vary significantly by type and pollutant)
- Avoids unnecessary project delays due to potential legal challenges



# Why Now?





# Quick Way to Satisfy Antidegradation Requirements (Don't Degrade)

---

- Step 1: Determine Pollutant Loading Criteria
- Step 2: Use "NO CHANGE" or 1065" Rule (if applicable)
- Step 3: Conduct Pollutant Loading Analysis (if "NO CHANGE" or "1065" Rule do not apply)
- Step 4: If chloride deicing chemicals are used, submit Salt Minimization Plan
- Step 5: Provide legally binding documentation (i.e., deed restrictions, easements, etc.), if needed
- Step 6: Future – Demonstration of no significant increase in water temperature in cold water fisheries (maintenance of riparian buffer)



## How to Satisfy Antidegradation Requirements (cont)

---

- Steps 1-6 assume all other AoT regulations are met including:
  - Peak Flow
  - Groundwater Recharge Volume
  - Inspection and maintenance of Erosion and Sediment Controls during construction
  - BMP Design (i.e., sized for WQF or WQV)
  - Long Term Maintenance Plan



# Proposed Process has been field tested

---

- Some projects (i.e., 401 Water Quality Certifications) have already been required to meet most of these requirements (its been field tested).
- Process can play significant role in site layout and/or selection of BMPs
  - Antidegradation often at tail end of design process—including in regulations and bringing to front of process will save time and money
- Have interim guidance. DES will work with workgroup on finalizing guidance.
- Goal is to provide designers with as many tools and as much flexibility as possible



# Step 1 Determine Pollutant Loading Criteria [Env-Wq 1507 (a),(b)]

---

Project Location	Pollutant Loading Criteria
w/in 1-mile upstream of an impaired surface water	No additional loading of pollutants causing the impairment <b>OR</b> Loading reductions per approved TMDL
Upstream of Outstanding Resource Waters (ORWs)	No additional loading of any pollutant <b>And</b> Loading reductions per approved TMDL
All other waters	No additional loading through “no change” or “1065” rule <b>OR</b> Full antidegradation review

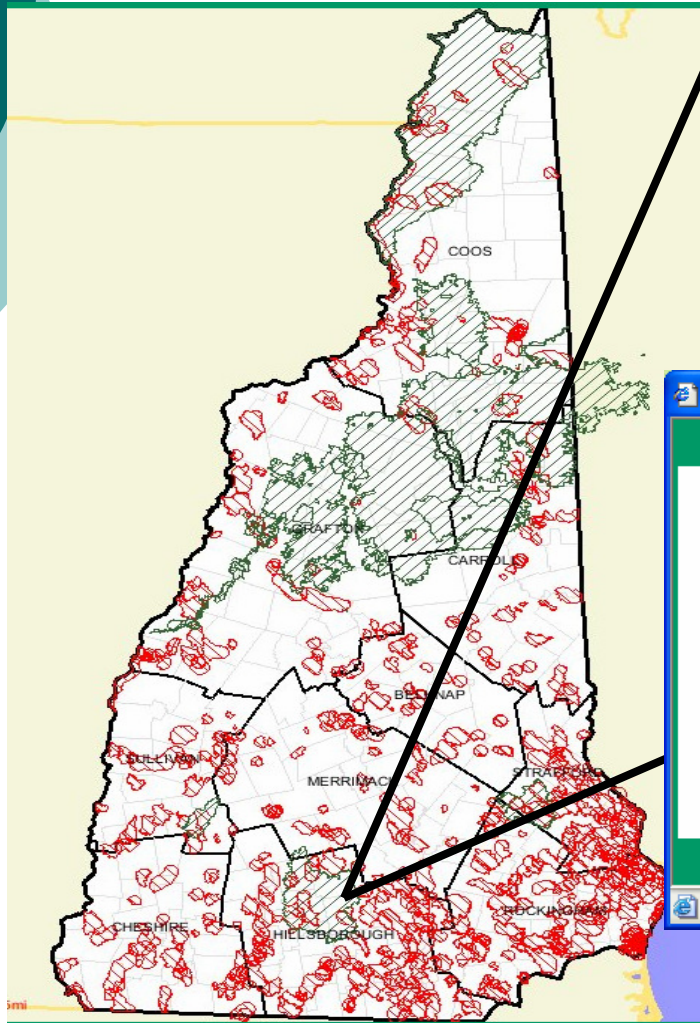


## Step 1 (cont)

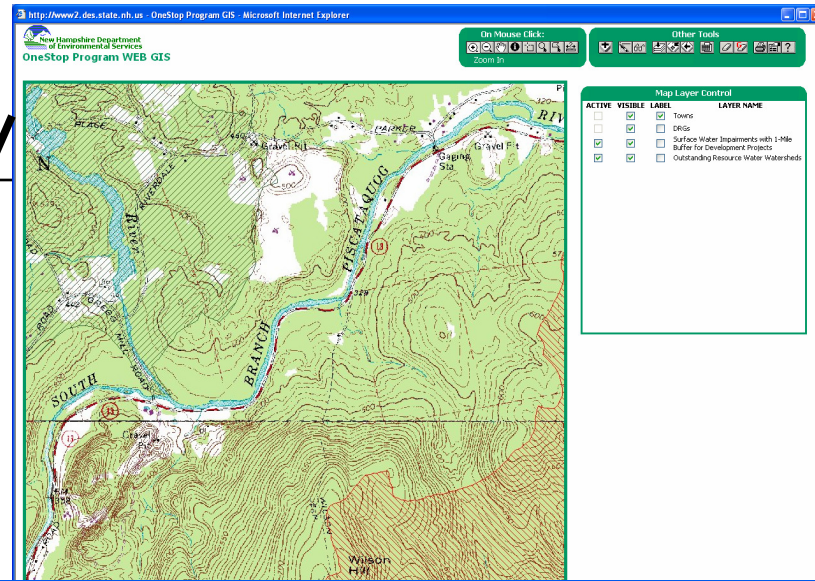
---

- Impaired Waters & ORW coverages are on DES One Stop website! <http://www2.des.state.nh.us/OneStop/>
  - Impaired Surface Waters with 1-mile buffer for Development Projects
    - Shows stormwater pollutants causing impairment
  - Outstanding Resource Waters (ORWs)
  - Similar GIS coverage/guidance coming for TMDL waters and eventually for cold water fisheries too (for temperature)
- Guidance coming soon on AoT Website
  - <http://des.nh.gov/organization/divisions/water/aot/index.htm>

# Step 1 (cont)



miles or 113160 Feet)



http://www2.des.state.nh.us - Identify Results - Microsoft Internet Explorer

### Identify Results

**LOCATION:** Latitude: 42° 59' 45.84" NH SP X: 989764.72  
Longitude: -71° 38' 45.79" NH SP Y: 180791.43

**Surface Water Impairments with 1-Mile Buffer for Development Projects**  
(Features returned: 1)

ASSESSMENT UNIT ID	BEACH?	ASSESSMENT UNIT NAME	IMPAIRMENTS
NHRIV700060607-02	N	BOG BROOK, CWF	DISSOLVED OXYGEN SATURATION; OXYGEN - DISSOLVED (mg/L)

**Outstanding Resource Water Watersheds**  
(Features returned: 0)

Close

Done Internet



## Step 1 (cont)

---

### 2008 Stormwater Related Impairments for Development (AoT) Projects

- Aluminum
- Ammonia (unionized)
- Benthic Macro-invertebrates
- Chlorophyll a
- Chloride
- Copper
- Cyanobacteria
- Dissolved Oxygen Saturation
- Enterococcus
- Escherichia coli
- Excessive Algal Growth
- Fecal Coliform
- Fish (Bioassessment)
- Lead
- Low Flow Alteration
- Nitrogen (total)
- Oxygen, Dissolved (mg/L)
- Phosphorus
- Sedimentation/Siltation
- Zinc





# Step 2 – Use “NO CHANGE” or “1065” Rule if applicable

(to be removed from regulations for now)

---

- “NO CHANGE” Rule: Env-Wq 1507.07(b)(2)
- “1065” Rule: Env-Wq 1507.07(b)(1)
- **Only applicable if project is:**
  - NOT within 1 mile upstream of impaired water
  - AND**
  - NOT upstream of an ORW
- Both depend on:
  - % Effective Impervious Cover (EIC)
  - % Undisturbed Cover (UDC)



## Step 2 (cont)

(to be removed from regulations for now)

---

### “NO CHANGE” Rule

If project has

NO CHANGE in % EIC

AND

NO CHANGE in % UDC

then NO Pollutant Loading Analysis is needed.  
Go to Step 4



## Step 2 (cont)

---

### "1065" Rule

If project has

$\leq 10\%$  EIC

AND

$\geq 65\%$  UDC

then NO Pollutant Loading Analysis is needed.  
Go to Step 4



## Step 2 (cont)

---

- $\% \text{ EIC} = \frac{\text{Area of EIC within project property}}{\text{Drainage area within property}} \times 100$

- $\% \text{ UDC} = \frac{\text{Area of UDC within project property}}{\text{Drainage area within property}} \times 100$



## Step 2 (cont)

---

### ○ DEFINITIONS

- Env-Wq 1502.28 “**Impervious cover**” means a structure or a land surface with a low capacity for infiltration, including but not limited to pavement, roofs, roadways, and compacted soils with a curve number of 98 or greater.

(note – gravel roadways are considered IC)

- Env-Wq 1502.17 “**Effective impervious cover**” means all impervious cover that is not disconnected impervious cover.



## Step 2 (cont)

---

### ○ DEFINITIONS

- Env-Wq 1502.14 “**Disconnected impervious cover**” means impervious cover that **does not contribute directly to stormwater runoff** from a site, but directs stormwater runoff to on-site pervious cover to infiltrate into the soil or be filtered by overland flow so that the net rate and volume of stormwater runoff from the disconnected impervious cover is not greater than the rate and volume from undisturbed cover of equal area.
- Env-Wq 1502.66 “**Undisturbed cover**” means a natural land surface whose permeability has not been altered by human activity.



## Step 2 (cont)

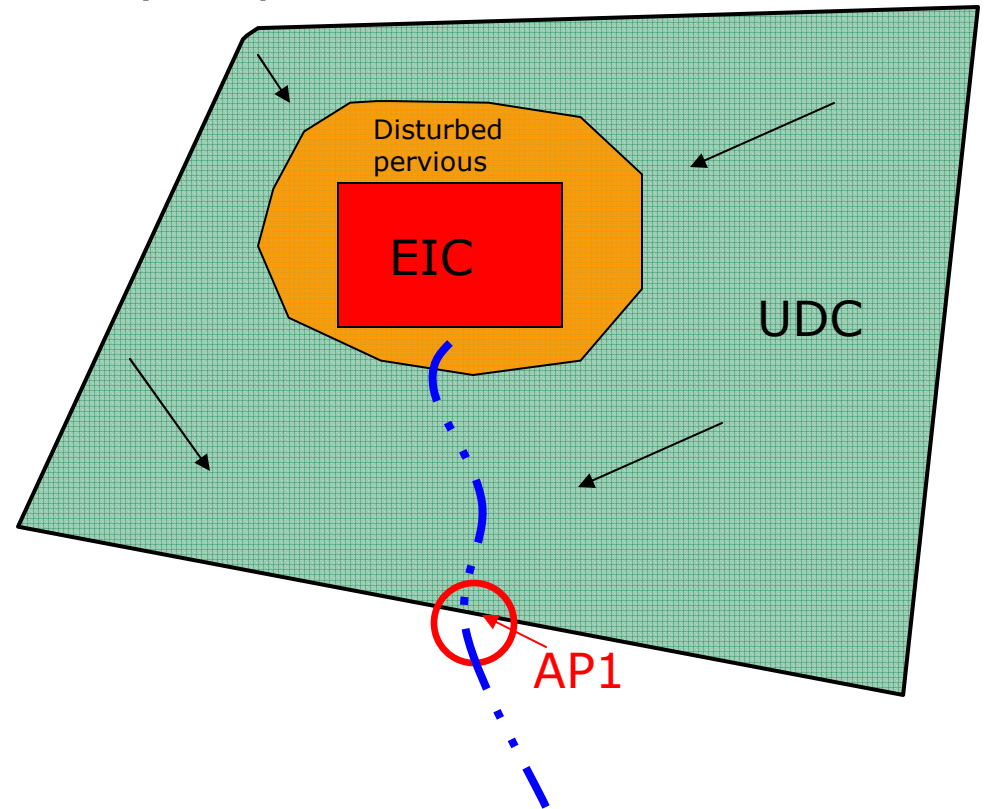
---

- Number of Analysis Points
  - “NO CHANGE”, “1065” or Pollutant Loading Analysis (discussed later) criteria must be met at the project property line wherever stormwater from a project discharges to a major surface water
  - These are called Analysis Points (AP)
  - Major surface waters are surface waters shown on USGS maps (1:24,000 or 1:25,000)
  - See following examples

## Step 2 (cont)

- Example 1: 1 outlet = 1 analysis point
- Property = 10ac

AP1
Drainage area = 10 ac
UDC = 7 ac
EIC = 1 ac
Disturbed pervious = 2 ac
$\%EIC = \frac{1}{10} \times 100 = 10\%$ ✓
$\%UDC = \frac{7}{10} \times 100 = 70\%$ ✓



Satisfies "1065" Rule – No pollutant loading analysis needed



## Step 2 (cont)

- Example 2: 2 outlets = 2 analysis points
- Property = 10ac

AP1
Drainage area = 6 ac
UDC = 4 ac
EIC = 1 ac
Disturbed pervious = 1 ac
$\%EIC = \frac{1}{6} \times 100 = 17\%$
$\%UDC = \frac{4}{6} \times 100 = 67\%$
AP2
Drainage area = 4 ac
UDC = 3.2 ac
EIC = 0.3 ac
Disturbed pervious = 0.5 ac
$\%EIC = \frac{0.3}{4} \times 100 = 7.5\%$
$\%UDC = \frac{3.2}{4} \times 100 = 80\%$

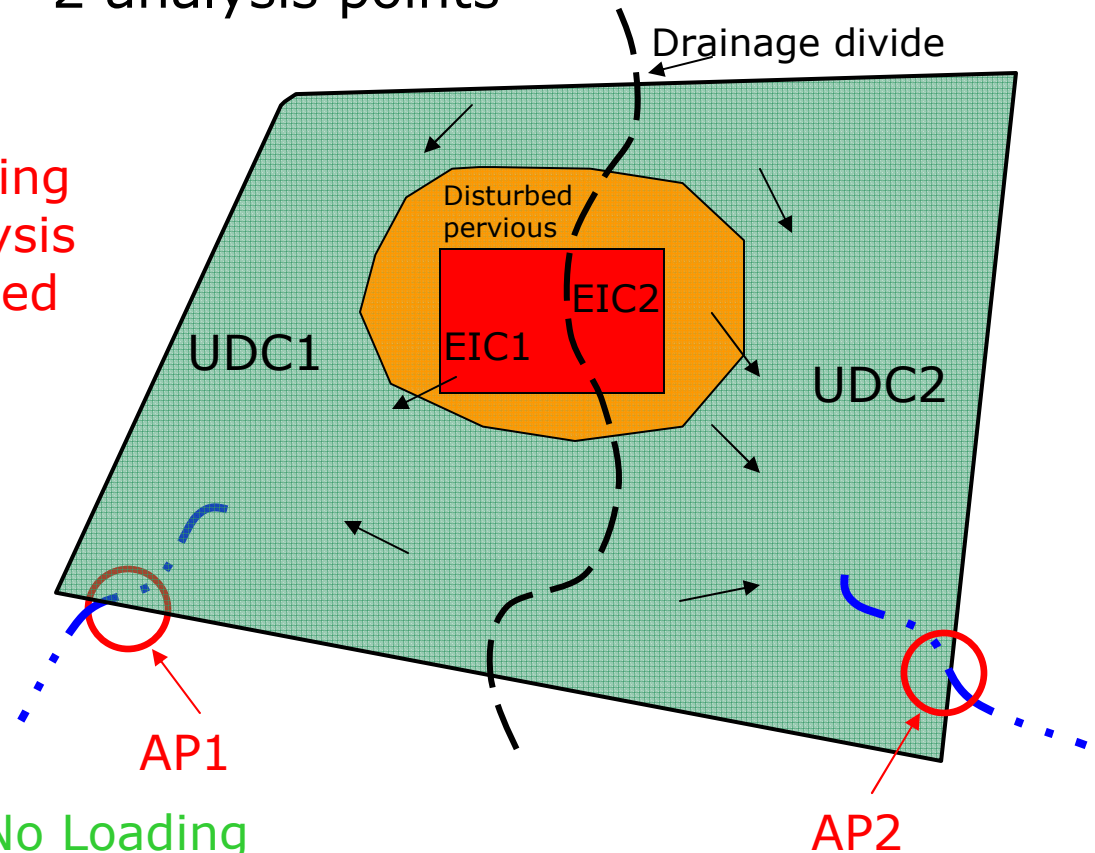
Loading  
analysis  
needed

✗

✓

✓ No Loading  
analysis  
needed

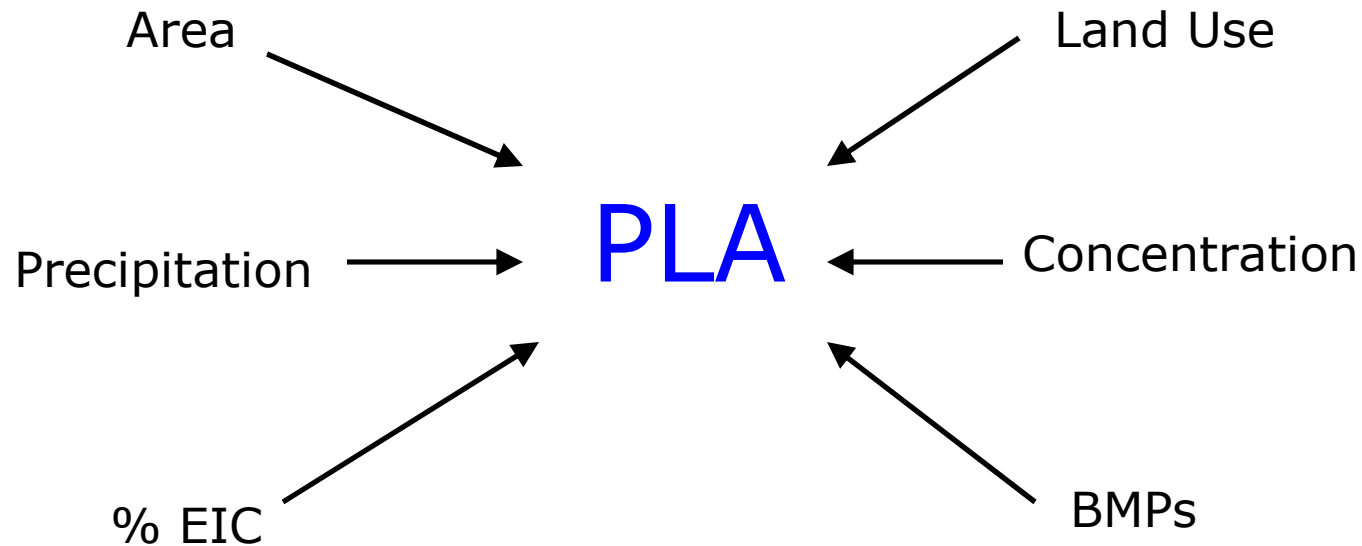
✓



# Step 3 Pollutant Loading Analysis

(PLA) [ Env-Wq 1507 (a) – to be removed  
from regulations for now]

---





# Step 3 Pollutant Loading Analysis

(PLA) [ Env-Wq 1507 (a) – to be removed from regulations for now]

---

- PLA needed if
  - can't meet "NO CHANGE" or "1065" Rule criteria
  - don't elect to go through Antidegradation Process per Env-Wq 1708
- PLA must demonstrate
  - No Additional Loading, and
  - Reduction in Loadings per any approved TMDL
- No Additional Loading means
  - Post Development  $\leq$  Pre Development Loadings
- No Additional Loading must be met at each Analysis Point (as discussed in Step 2)



## Step 3 (cont)

---

- TSS, TN, TP : Surrogate Pollutants for PLA
  - No Additional Loading applies to all pollutants
  - Due to data gaps (see Note below) Total Suspended Solids (TSS), Total Phosphorus (TP) and Total Nitrogen (TN) are currently considered by DES to be surrogates for all pollutants for PLA.
  - Assumption is that if hold the load for TSS, TP and TN, loads for all other pollutants will be held as well (i.e., NO DEGRADATION).



## Step 3 (cont)

---

- Many Pollutant Loading models are available
- DES recommends model based on “Simple Method” (very easy)
  - DES has developed Excel Workbook
    - Will be available on AoT website
    - Is set up to calculate and compare pre and post loads
- Hydrocad adding Simple Method



## Step 3 (cont)

---

$$L_{sm} = A * C * P * P_j * (0.05 + \%EIC/100) * CF$$

$$L_f = L_{sm} - (L_{sm} * RE/100)$$

Where for each Land Use:

- $L_{sm}$  = Simple Method Annual Load (mass/yr)
- A = Area (acres)
- C = Pollutant concentration (mass/volume)
- P = Annual Precipitation (inches/year)
- $P_j$  = Fraction of annual rainfall events that produce runoff (usually 0.9)
- $\% EIC = EIC / A * 100$
- CF = Conversion Factor
- $L_f$  = Final Annual Load (mass/year)
- RE = BMP Removal Efficiency (%)



## Step 3 (cont)

---

- For Chemicals:

- $L_{sm}$  and  $L_f$  are in lbs/year
- $C$  is in mg/L
- $CF$  is 0.226

- For Bacteria:

- $L_{sm}$  and  $L_f$  are in billion colonies/year
- $C =$  is in colonies/100ml
- $CF =$  Conversion Factor is  $1.03 * 10^{-3}$



## Step 3 (cont)

---

- **DES Simple Method Excel Workbook**





## Step 3 (cont)

---

### ○ Sub-Areas

- Each Workbook can accommodate 25 Pre & Post Sub-Areas
- Sub-Areas are defined by User
- Each Sub-Area can have different and multiple Land Uses with different % EIC
- Only 1 BMP can be assigned to each Sub-Area and it is assumed to treat the entire Sub-Area
  - Sub-Areas with similar BMPs can be grouped together to reduce number of Sub-Areas
- Number of Pre & Post Sub-Areas can be different but **Total Area of Pre Sub-Areas should = Total Area of Post Sub-Areas for the project** (and usually for each Analysis Point-but not always)

## Step 3 (cont)

### **EXAMPLE 1: Sub-Areas**

- Total Project Area = 100 acres
- All Drainage flows to 1 stream (i.e., 1 Analysis Point)
- Pre development
  - 100 Acres Forested with no BMPs
- Post development
  - 20 Acre Commercial with 65% EIC to Wet Ext Detention Pond 1
  - 10 Acres Industrial with 45% EIC to Wet Ext Detention Pond 2
  - 30 Acres Residential with 30% IC but **0% EIC** since it is treated by an Infiltration Basin (**i.e., Disconnected**)
  - 40 Acre Forested (Undisturbed Cover) with no BMP

PRE					POST				
Sub-Area	Land Use	A (acres)	% EIC	BMP	Sub-Area	Land Use	A (acres)	% EIC	BMP
PRE-1	Forest	100	0%	None	POST-1	Commercial Industrial	20 10	65% 45%	Wet Extended Detention Pond
					POST-2	Residential	30	0%	Infiltration Basin (Disconnected)
					POST-3	Forest	40	0%	None
Total		100					100		



## Step 3 (cont)

---

- 2 Input Worksheets

- “Input\_LU\_A\_Ia\_C”
- “Input BMPs”
- Can insert additional worksheets as needed to support input such as % EIC calculations (this is encouraged)
- The following “Print Screen” shots include input for EXAMPLE 1



## Step 3 (cont)

---

- “Input\_LU\_A\_Ia\_C” Worksheet
  - Date and General Project Information
  - P (get mean precipitation for closest town/city from [http://www.erh.noaa.gov/gyx/climo/NH\\_STATS\\_NEW.htm](http://www.erh.noaa.gov/gyx/climo/NH_STATS_NEW.htm))
  - Pj (set = 0.9)
  - Land Use (LU) for each Pre & Post Sub-Area
  - A for each LU in each Pre & Post Sub-Area
  - % EIC (shown as Ia in worksheet) for each A in each Pre & Post Sub-Area
  - C for each LU (automatic input)

# Step 3 (cont)

Precipitation table from

([http://www.erh.noaa.gov/gyx/climo/NH\\_STATS\\_NEW.htm](http://www.erh.noaa.gov/gyx/climo/NH_STATS_NEW.htm))

NEW HAMPSHIRE

WORKSHEET FOR MONTHLY STATION NORMALS OF  
TEMPERATURE, PRECIPITATION, AND  
HEATING AND COOLING DEGREE DAYS 1971-2000

=====														
TEMPERATURE NORMALS (Degrees Fahrenheit)														
STATION NAME	ELEMENT	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
=====														
BENTON 5 SW	MAX	26.3	28.7	38.7	51.1	65.0	72.8	77.3	74.9	66.6	55.2	42.3	31.2	52.5
	MEAN	15.9	17.9	28.6	40.8	53.6	61.8	66.2	64.0	55.9	44.8	33.8	22.0	42.1
	MIN	5.4	7.0	18.5	30.5	42.2	50.7	55.1	53.1	45.2	34.3	25.2	12.8	31.7
BERLIN	MAX	26.1	29.6	38.9	51.2	65.4	73.7	78.1	76.2	67.5	55.7	42.7	30.9	53.0
	MEAN	15.1	18.0	28.0	40.6	53.1	62.1	66.4	64.5	55.9	44.9	34.3	21.4	42.0
	MIN	4.0	6.4	17.1	30.0	40.8	50.4	54.7	52.7	44.2	34.1	25.8	11.9	31.0
BETHLEHEM	MAX	25.6	30.0	40.4	53.3	67.9	74.9	78.7	76.2	67.1	54.9	41.0	29.9	53.3
	MEAN	16.0	19.3	29.6	41.6	54.5	62.5	66.7	64.6	56.1	45.0	33.4	21.3	42.6
	MIN	6.3	8.6	18.7	29.9	41.1	50.0	54.6	53.0	45.1	35.0	25.8	12.7	31.7
BLACKWATER DAM	MAX	29.6	33.6	42.5	54.6	67.6	76.1	80.9	78.6	70.0	58.6	46.1	34.3	56.0
	MEAN	18.9	22.2	31.7	43.3	55.0	63.6	68.4	66.4	57.5	46.3	36.6	24.8	44.6
	MIN	8.1	10.7	20.8	32.0	42.3	51.0	55.9	54.1	45.0	34.0	27.1	15.2	33.0
COLEBROOK	MAX	23.8	26.9	37.1	50.0	64.5	72.7	77.3	74.8	66.1	54.2	40.9	28.6	51.4
	MEAN	12.0	14.1	25.9	39.2	52.0	61.0	65.5	63.3	55.1	43.4	32.1	18.8	40.2
	MIN	0.2	1.2	14.7	28.3	39.5	49.3	53.7	51.7	44.1	32.5	23.2	8.9	28.9
CONCORD MUNICIPAL AP	MAX	30.6	34.1	43.8	56.9	69.6	77.9	82.9	80.8	72.1	60.5	47.6	35.6	57.7
	MEAN	20.1	23.3	33.3	44.6	56.0	64.9	70.0	68.2	59.4	47.8	37.6	25.9	45.9
	MIN	9.7	12.6	22.7	32.2	42.4	51.8	57.1	55.6	46.6	35.1	27.6	16.2	34.1
DEERING	MAX	29.4	33.2	42.5	55.2	67.7	74.3	78.1	75.7	67.5	56.8	44.6	33.3	54.9
	MEAN	21.5	24.5	33.6	44.8	56.7	64.3	68.6	66.7	58.7	48.2	37.6	26.1	45.9
	MIN	13.5	15.7	24.6	34.3	45.7	54.3	59.0	57.6	49.9	39.5	30.6	18.9	37.0

P = 45.9 inches  
Concord

Done

Internet

start

20081102\_AoT works...

PowerPoint Slide Sho...

Book1

20080307\_DES\_SIMP...

NH CLIMATE NORMA...

4:18 PM

P = 45.9 inches for  
Concord

# Step 3 (cont)

**General Project Info, P, Pj**, Sub-Areas, Land Uses, Area, % EIC (= Ia), C  
(Input is for Example 1)

Microsoft Excel - 20080307\_DES\_SIMPLE\_METHOD (version 1) for 20081105\_AoT\_Seminar

File Edit View Insert Format Tools Data Window Help

Type a question for help

120%

1	Date (MM/DD/YYYY):			11/5/2008				
2	Project Name:			AoT Training				
3	Town/City:			Concord				
4	Impacted Surface Waters:			Some Stream				
5	Applicant:			DES				
6	DES File #:			#2008-001				
7								
8	Average Annual Precipitation P			45.90 inches				
9	Fraction of Annual Runoff events that produce runoff			0.90 (usually 0.9)				
10								
11								
12								
13								
14	Sub_Area_ID	1-PRE		Sub_Area_ID	1-POST			
15								
16	Land Use	Area	Ia	Land Use	Area	Ia		
17		(acres)	(% Impervious)		(acres)	(% Impervious)		
18	From HWG			From HWG				
19	Residential Roof	0.00	0.00%	Residential Roof	0.00	0.00%		
20	Commercial Roof	0.00	0.00%	Commercial Roof	0.00	0.00%		
21	Industrial Roof	0.00	0.00%	Industrial Roof	0.00	0.00%		
22	Commercial/Res Parking	0.00	0.00%	Commercial/Res Parking	0.00	0.00%		
23	Industrial Parking	0.00	0.00%	Industrial Parking	0.00	0.00%		
24	Residential Street	0.00	0.00%	Residential Street	0.00	0.00%		
25	Commercial Street	0.00	0.00%	Commercial Street	0.00	0.00%		
26	Rural Highway	0.00	0.00%	Rural Highway	0.00	0.00%		
27	Urban Highway	0.00	0.00%	Urban Highway	0.00	0.00%		
28	Lawns	0.00	0.00%	Lawns	0.00	0.00%		
29	Landscaping	0.00	0.00%	Landscaping	0.00	0.00%		
30	Driveway	0.00	0.00%	Driveway	0.00	0.00%		
31	Heavy Industrial	0.00	0.00%	Heavy Industrial	0.00	0.00%		

ONLY CHANGE VALUES SHADED IN BLUE

PRE-DEVELOPMENT CONDITIONS POST-DEVELOPMENT CONDITIONS

Insert information for 1st sub-area below

Instructions Input LU A Ia C Input BMPs SUMMARY

Reply with Changes... End Review...

start 20081102\_AoT works... Book1 20080307\_DES\_SIMP... 3:20 PM

# Step 3 (cont)

General Project Info, P, Pj, **Sub-Areas, Land Uses, Area ,% EIC (= Ia), C**  
**(Input is for Example 1)**

Microsoft Excel - 20080307\_DES\_SIMPLE\_METHOD (version 1) for 20081105\_AoT\_Seminar

File Edit View Insert Format Tools Data Window Help

Type a question for help

120%

	A	B	C	D	E	F	G	H
13			Insert information for 1st sub-area below					
14	Sub_Area_ID	1-PRE		Sub_Area_ID	1-POST			
15								
16	Land Use	Area	Ia	Land Use	Area	Ia		Land
17		(acres)	(% Impervious)		(acres)	(% Impervious)		
18	From HWG			From HWG				From HWG
19	Residential Roof	0.00	0.00%	Residential Roof	0.00	0.00%		
20	Commercial Roof	0.00	0.00%	Commercial Roof	0.00	0.00%		
21	Industrial Roof	0.00	0.00%	Industrial Roof	0.00	0.00%		
22	Commercial/Res Parking	0.00	0.00%	Commercial/Res Parking	0.00	0.00%		Comme
23	Industrial Parking	0.00	0.00%	Industrial Parking	0.00	0.00%		
24	Residential Street	0.00	0.00%	Residential Street	0.00	0.00%		F
25	Commercial Street	0.00	0.00%	Commercial Street	0.00	0.00%		C
26	Rural Highway	0.00	0.00%	Rural Highway	0.00	0.00%		
27	Urban Highway	0.00	0.00%	Urban Highway	0.00	0.00%		
28	Lawns	0.00	0.00%	Lawns	0.00	0.00%		
29	Landscaping	0.00	0.00%	Landscaping	0.00	0.00%		
30	Driveway	0.00	0.00%	Driveway	0.00	0.00%		
31	Heavy Industrial	0.00	0.00%	Heavy Industrial	0.00	0.00%		
32	Residential (general)	0.00	0.00%	Residential (general)	0.00	0.00%		Res
33	Commercial (general)	0.00	0.00%	Commercial (general)	0.00	0.00%		Com
34	Industrial (general)	0.00	0.00%	Industrial (general)	0.00	0.00%		Ir
35	From CDM			From CDM				From CDM
36	Agriculture and Pasture	0.00	0.00%	Agriculture and Pasture	0.00	0.00%		Agricu
37	Commercial	0.00	0.00%	Commercial	20.00	65.00%		
38	Forest/Rural Open	100.00	0.00%	Forest/Rural Open	0.00	0.00%		F
39	Highway	0.00	0.00%	Highway	0.00	0.00%		
40	Industrial	0.00	0.00%	Industrial	10.00	45.00%		
41	Medium Density Residential	0.00	0.00%	Medium Density Residential	0.00	0.00%		Medium D
42	Urban Open	0.00	0.00%	Urban Open	0.00	0.00%		
43	Water/Wetland	0.00	0.00%	Water/Wetland	0.00	0.00%		

Instructions Input LU A Ia C Input BMPs SUMMARY

Reply with Changes... End Review...

start 20081102\_AoT works... Book1 20080307\_DES\_SIMP... 3:21 PM



# Step 3 (cont)

General Project Info, P, Pj, **Sub-Areas, Land Uses, Area ,% EIC (= Ia), C**  
**(Input is for Example 1)**

Microsoft Excel - 20080307\_DES\_SIMPLE\_METHOD (version 1) for 20081105\_AoT\_Seminar

Type a question for help

	A	B	C	D	E	F	G	H
44								
45	Sub_Area_ID	2-PRE			Sub_Area_ID	2-POST		
46								
47	Land Use	Area	Ia		Land Use	Area	Ia	
48		(acres)	(% Impervious)			(acres)	(% Impervious)	
49	From HWG				From HWG			
50	Residential Roof	0.00	0.00%		Residential Roof	0.00	0.00%	
51	Commercial Roof	0.00	0.00%		Commercial Roof	0.00	0.00%	
52	Industrial Roof	0.00	0.00%		Industrial Roof	0.00	0.00%	
53	Commercial/Res Parking	0.00	0.00%		Commercial/Res Parking	0.00	0.00%	
54	Industrial Parking	0.00	0.00%		Industrial Parking	0.00	0.00%	
55	Residential Street	0.00	0.00%		Residential Street	0.00	0.00%	
56	Commercial Street	0.00	0.00%		Commercial Street	0.00	0.00%	
57	Rural Highway	0.00	0.00%		Rural Highway	0.00	0.00%	
58	Urban Highway	0.00	0.00%		Urban Highway	0.00	0.00%	
59	Lawns	0.00	0.00%		Lawns	0.00	0.00%	
60	Landscaping	0.00	0.00%		Landscaping	0.00	0.00%	
61	Driveway	0.00	0.00%		Driveway	0.00	0.00%	
62	Heavy Industrial	0.00	0.00%		Heavy Industrial	0.00	0.00%	
63	Residential (general)	0.00	0.00%		Residential (general)	0.00	0.00%	
64	Commercial (general)	0.00	0.00%		Commercial (general)	0.00	0.00%	
65	Industrial (general)	0.00	0.00%		Industrial (general)	0.00	0.00%	
66	From CDM				From CDM			
67	Agriculture and Pasture	0.00	0.00%		Agriculture and Pasture	0.00	0.00%	
68	Commercial	0.00	0.00%		Commercial	0.00	0.00%	
69	Forest/Rural Open	0.00	0.00%		Forest/Rural Open	0.00	0.00%	
70	Highway	0.00	0.00%		Highway	0.00	0.00%	
71	Industrial	0.00	0.00%		Industrial	0.00	0.00%	
72	Medium Density Residential	0.00	0.00%		Medium Density Residential	30.00	0.00%	
73	Urban Open	0.00	0.00%		Urban Open	0.00	0.00%	
74	Water/Wetland	0.00	0.00%		Water/Wetland	0.00	0.00%	

Instructions Input LU A Ia C Input BMPs SUMMARY

Reply with Changes... Egd Review...

start 20081102\_AoT... 20080307\_DES... BMP Efficiency a... Jilians Guidance Appendix E - BM... 20081001\_Volu... 4:51 PM



# Step 3 (cont)

General Project Info, P, Pj, **Sub-Areas, Land Uses, Area ,% EIC (= Ia), C**  
**(Input is for Example 1)**

Microsoft Excel - 20080307\_DES\_SIMPLE\_METHOD (version 1) for 20081105\_AoT\_Seminar

	A	B	C	D	E	F	G	H
75			Insert information for 3rd sub-area below					
76	Sub_Area_ID	3-PRE		Sub_Area_ID	3-POST			
77								
78	Land Use	Area	Ia	Land Use	Area	Ia		
79		(acres)	(% Impervious)		(acres)	(% Impervious)		
80	From HWG			From HWG				
81	Residential Roof	0.00	0.00%	Residential Roof	0.00	0.00%		
82	Commercial Roof	0.00	0.00%	Commercial Roof	0.00	0.00%		
83	Industrial Roof	0.00	0.00%	Industrial Roof	0.00	0.00%		
84	Commercial/Res Parking	0.00	0.00%	Commercial/Res Parking	0.00	0.00%		
85	Industrial Parking	0.00	0.00%	Industrial Parking	0.00	0.00%		
86	Residential Street	0.00	0.00%	Residential Street	0.00	0.00%		
87	Commercial Street	0.00	0.00%	Commercial Street	0.00	0.00%		
88	Rural Highway	0.00	0.00%	Rural Highway	0.00	0.00%		
89	Urban Highway	0.00	0.00%	Urban Highway	0.00	0.00%		
90	Lawns	0.00	0.00%	Lawns	0.00	0.00%		
91	Landscaping	0.00	0.00%	Landscaping	0.00	0.00%		
92	Driveway	0.00	0.00%	Driveway	0.00	0.00%		
93	Heavy Industrial	0.00	0.00%	Heavy Industrial	0.00	0.00%		
94	Residential (general)	0.00	0.00%	Residential (general)	0.00	0.00%		
95	Commercial (general)	0.00	0.00%	Commercial (general)	0.00	0.00%		
96	Industrial (general)	0.00	0.00%	Industrial (general)	0.00	0.00%		
97	From CDM			From CDM				
98	Agriculture and Pasture	0.00	0.00%	Agriculture and Pasture	0.00	0.00%		
99	Commercial	0.00	0.00%	Commercial	0.00	0.00%		
100	Forest/Rural Open	0.00	0.00%	Forest/Rural Open	40.00	0.00%		
101	Highway	0.00	0.00%	Highway	0.00	0.00%		
102	Industrial	0.00	0.00%	Industrial	0.00	0.00%		
103	Medium Density Residential	0.00	0.00%	Medium Density Residential	0.00	0.00%		
104	Urban Open	0.00	0.00%	Urban Open	0.00	0.00%		
105	Water/Wetland	0.00	0.00%	Water/Wetland	0.00	0.00%		

Instructions Input LU A Ia C Input BMPs SUMMARY

20081102\_AoT works... Book1 20080307\_DES\_SIMP... 3:24 PM

# Step 3 (cont)

General Project Info, P, Pj, Sub-Areas, Land Uses, Area ,% EIC (= Ia), **C**  
(Input is for Example 1)

Microsoft Excel - 20080307\_DES\_SIMPLE\_METHOD (version 1) for 20081105\_AoT\_Seminar

File Edit View Insert Format Tools Data Window Help

Type a question for help

120%

	I	J	K	L	M	N	O	P	Q	R	S	T	U
14	EVENT MEAN CONCENTRATIONS (EMC OR C IN SIMPLE METHOD) (Only change values in BLUE)												
15													
16	Land Use	TSS	TDS	BOD	COD	TP	DP	TN	TKN	NO3_NO2	E. coli	FECAL	Pb
17		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	colonies/100 ML	colonies/100 ML	mg/L
18	From HWG												
19	Residential Roof	19				0.11		1.50				2600	0.02
20	Commercial Roof	9		21		0.14		2.10				1100	0.01
21	Industrial Roof	17										5800	0.04
22	Commercial/Res Parking	27		21		0.15		1.90				1800	0.02
23	Industrial Parking	228											0.08
24	Residential Street	172				0.55		1.40				37000	0.05
25	Commercial Street	468										12000	0.17
26	Rural Highway	51						22.00					0.08
27	Urban Highway	142				0.32		3.00					0.40
28	Lawns	80		3		2.10		9.10				24000	0.01
29	Landscaping	37		3		0.11		1.74					0.02
30	Driveway	173				0.56		2.10				17000	
31	Heavy Industrial	124											0.29
32	Residential (general)	100				0.40		2.20					0.01
33	Commercial (general)	75		21		0.20		2.00					0.37
34	Industrial (general)	120		24		0.40		2.50					
35	From CDM												
36	Agriculture and Pasture	145		3		0.37		5.98				5000	0.00
37	Commercial	77		21		0.33		2.97				2600	0.04
38	Forest/Rural Open	51		3		0.11		1.74				300	0.00
39	Highway	141		24		0.43		2.65				600	0.04
40	Industrial	149		24		0.32		3.97				600	0.07
41	Medium Density Residential	70		38		0.52		5.15				2500	0.05
42	Urban Open	51		3		0.11		1.74				5000	0.01
43	Water/Wetland	6		4		0.08		1.38				300	0.01
44													

Instructions Input LU A Ia C Input BMPs SUMMARY

Reply with Changes... End Review...

start 20081102\_AoT works... Book1 20080307\_DES\_SIMP... 3:31 PM



## Step 3 (cont)

---

- **“Input BMPs”** Worksheet

- Input BMP and RE for each for each Sub-Area for Pre and Post
- Note if BMPs are in **Series**, input highest RE for each BMP for each pollutant

## Step 3 (cont)

### ○ BMP in Series Example

#### **Wet Extended Detention Pond**

TSS RE = 80%

TP RE = **68%**

TN RE = 55%

#### **Infiltration Basin**

TSS RE = **90%**

TP RE = 65%

TN RE = **60%**

would be input as:

#### **Wet Extended Detention Pond/Infiltration Basin in Series**

TSS RE = **90%**

TP RE = **68%**

TN RE = **60%**

# Step 3 (cont)

## Examples of BMP Removal Efficiencies (RE)

BMP Type	BMP 1,2,3,4,5,6,7	Notes	Lit. Ref.	Values accepted for Loading Analyses		
				TSS	TN	TP
Stormwater Ponds	Wet Pond		B,F	70%	35%	45%
	Wet Extended Detention Pond		A,B	80%	55%	68%
	Micropool Extended Detention Pond	TBA				
	Multiple Pond System	TBA				
	Pocket Pond	TBA				
Stormwater Wetlands	Shallow Wetland		A,B,F,I	80%	55%	45%
	Extended Detention Wetland		A,B,F,I	80%	55%	45%
	Pond/Wetland System	TBA				
	Gravel Wetland		H	95%	85%	64%
Infiltration Practices	Infiltration Trench (≥75 ft from surface water)		B,D,I	90%	55%	60%
	Infiltration Trench (<75 ft from surface water)		B,D,I	90%	10%	60%
	Infiltration Basin (≥75 ft from surface water)		A,F,B,D,I	90%	60%	65%
	Infiltration Basin (<75 ft from surface water)		A,F,B,D,I	90%	10%	65%
	Dry Wells			90%	55%	60%
	Drip Edges			90%	55%	60%
Filtering Practices	Aboveground or Underground Sand Filter that infiltrates WQV (≥75 ft from surface water)		A,F,B,D,I	90%	60%	65%
	Aboveground or Underground Sand Filter that infiltrates WQV (<75 ft from surface water)		A,F,B,D,I	90%	10%	65%
	Aboveground or Underground Sand Filter with underdrain		A,I,F,G,H	85%	10%	45%
	Tree Box Filter	TBA				
	Bioretention System		I,G,H	90%	65%	65%
	Permeable Pavement that infiltrates WQV (≥75 ft from surface water)		A,F,B,D,I	90%	60%	65%
	Permeable Pavement that infiltrates WQV (<75 ft from surface water)		A,F,B,D,I	90%	10%	65%
	Permeable Pavement with underdrain		Use TN and TP values for sand filter w/ underdrain and outlet pipe	90%	10%	45%
Treatment Swales	Flow Through Treatment Swale	TBA				
Vegetated Buffers	Vegetated Buffers		A,B,I	73%	40%	45%

# Step 3 (cont)

## BMP Removal Efficiencies (RE) (Input is for Example 1)

Microsoft Excel - 20080307_DES_SIMPLE_METHOD (version 1) for 20081105_AoT_Seminar										
File Edit View Insert Format Tools Data Window Help										
Type a question for help										
B34										
A B C D E F G H I J K										
PRE DEVELOPMENT		INPUT BMP DESCRIPTIONS				INPUT OVERALL REMOVAL EFFICIENCIES (%) F				
Sub-Area		TSS	TDS	BOD	COD	TP	DP	TN	TKN	
1-PRE		None	0%	0%	0%	0%	0%	0%	0%	
2-PRE			0%	0%	0%	0%	0%	0%	0%	
3-PRE			0%	0%	0%	0%	0%	0%	0%	
4-PRE			0%	0%	0%	0%	0%	0%	0%	
5-PRE			0%	0%	0%	0%	0%	0%	0%	
6-PRE			0%	0%	0%	0%	0%	0%	0%	
7-PRE			0%	0%	0%	0%	0%	0%	0%	
8-PRE			0%	0%	0%	0%	0%	0%	0%	
9-PRE			0%	0%	0%	0%	0%	0%	0%	
10-PRE			0%	0%	0%	0%	0%	0%	0%	
POST DEVELOPMENT		INPUT BMP DESCRIPTIONS				INPUT OVERALL REMOVAL EFFICIENCIES (%) F				
Sub-Area		TSS	TDS	BOD	COD	TP	DP	TN	TKN	
1-POST		Wet Extended Detention Pond	80%	0%	0%	68%	0%	55%	0%	
2-POST		Infiltration Basin	90%	0%	0%	65%	0%	60%	0%	
3-POST		None	0%	0%	0%	0%	0%	0%	0%	
4-POST			0%	0%	0%	0%	0%	0%	0%	
5-POST			0%	0%	0%	0%	0%	0%	0%	
6-POST			0%	0%	0%	0%	0%	0%	0%	
7-POST			0%	0%	0%	0%	0%	0%	0%	
8-POST			0%	0%	0%	0%	0%	0%	0%	
9-POST			0%	0%	0%	0%	0%	0%	0%	
10-POST			0%	0%	0%	0%	0%	0%	0%	
Instructions Input_LU_A_1a_C Input BMPs SUMMARY										
Draw AutoShapes										
Reply with Changes... End Review...										
Ready										
NUM										
start Stormwater Loading ... Start Menu Microsoft PowerPoint ... Microsoft Excel - 200... 7:33 PM										



## Step 3 (cont)

---

- **“Summary”** Worksheet

- After input is complete, check “Summary” Worksheet to see if PLA Criteria (e.g.  $\text{Post} \leq \text{Pre}$ ) have been met
- If criteria have been met, go to Step 4
- If criteria have not been met, need to find ways to further reduce pollutant loadings



# Step 3 (cont)

Microsoft Excel - 20080307\_DES\_SIMPLE\_METHOD (version 1) for 20081105\_AoT\_Seminar

Summary Worksheet for Example 1

	A	B	C	G	I
1	Date (MM/DD/YYYY):	11/5/2008			
2	Project Name:	AoT Training			
3	Town/City:	Concord			
4	Impacted Surface Waters:	Some Stream			
5	Applicant:	DES			
6					
7	TOTAL PRE DEVELOPMENT AREA (ACRES)	100.00			
8	TOTAL POST DEVELOPMENT AREA (ACRES)	100.00			
9					
10			TSS	TP	TN
11	PRE DEVELOPMENT LOADS (NO BMPS)		2381	5	81
12	PRE DEVELOPMENT LOADS (WITH BMPS)		2381	5	81
13	PRE DEVELOPMENT LOAD REDUCTION DUE TO BMPS		0.0	0.0	0.0
14					
15	POST DEVELOPMENT LOADS (NO BMPS)		17392	62	625
16	POST DEVELOPMENT LOADS (WITH BMPS)		4142	21	296
17	POST DEVELOPMENT LOAD REDUCTION DUE TO BMPS		(13249.5)	(40.6)	(329.7)
18					
19					
20	POST DEVELOPMENT - PRE DEVELOPMENT (SHOULD BE 0 OR NEGATIVE)		1761.4	16.3	214.5
21	% DIFFERENCE FROM PRE DEVELOPMENT LOADS (SHOULD BE 0 OR NEGATIVE)		74%	318%	264%
22					
23					
24					

Post > Pre for TSS, TP, TN; therefore antidegradation **NOT** met – need to remove more pollutants

5:05 PM





## Step 3 (cont)

---

- Examples of ways to further reduce Pollutant Loadings
  - Select BMPs with higher removal efficiencies
  - Disconnect more impervious area
  - Assign more area as Forest by placing more land in conservation easements or deed restrictions (if on individual lots)
  - Use fertilizer with no or low TP and low TN
    - Most soils in NH have sufficient TP
    - Working on ways to determine credit for this
    - Need to include in deed restriction

## Step 4 Salt Minimization Plan (SMP)

---





## Step 4 Salt Minimization Plan (SMP)

---

- “NO CHANGE”, “1065” Rule, and Pollutant Loading Analyses only address reactive pollutants that can be treated by structural BMPs (e.g., infiltration basins, detention ponds etc.)
- Most projects use deicing chemicals containing chlorides (i.e. rock salt) to clear roads, parking lots and sidewalks of ice
- Chlorides (Cl) are non-reactive and therefore can’t be treated by structural BMPs
- Chlorides in high concentrations can harm aquatic life (several surface waters currently violate chloride criteria)
- **If planning to use chloride deicing chemicals, must demonstrate compliance with DES Salt Minimization Plan (SMP) guidance to satisfy antidegradation requirements**



## Step 4 (cont)

---

### ○ SMP Requirements (Draft)

- Project description;
- Description of receiving waters and chloride impaired waters;
- Description of deicing chemicals and plan showing where they will be used;
- Description and plan showing where pervious asphalt or concrete will be used or an explanation as to why it is not suitable for this site;
- Table showing the areas of roads, parking lots and sidewalks (separate area for each category) where chloride deicing chemicals will be applied and total area of pervious pavement and pervious concrete;
- Legally binding documentation demonstrating how salt reductions specified in any applicable approved chloride TMDL will be achieved;
- Certification signed by the party responsible for applying chloride deicing chemicals

Pervious  
Pavement  
can reduce →  
salt use by  
up to 75%



## Step 4 (cont)

---

- Certifications

- Signed by Party Responsible (PR) for applying chloride deicing chemicals
  - If private, PR can be entity responsible for hiring private applicator or private applicator
  - If town applies salt, town is PR and must sign
- Different certification required depending on if receiving water is impaired or not impaired for chlorides



## Step 4 (cont)

---

- BOTH certifications state that PR will try to minimize chloride deicers by
  - Reading DES SMP Guidance & MN Winter Maintenance Manuals
  - Training operators to calibrate spreading equipment per MN
  - Following MN guidance salt application rates as best they can recognizing that it's guidance and that weather and need to protect public safety may necessitate different application rates at times
  - Cover salt piles



## Step 4 (cont)

---

- Certification for projects upstream of chloride impaired surface waters ALSO states that PR will:
  - Track amount of chloride applied and application rate during each storm event that chloride is applied
  - Maintain records for 5 years
  - Submit annual summary report to DES Watershed Management Bureau by May 1 of each year

# Step 5 Legal Documents (LDs)

## Example Deed Restriction

THIS DEED RESTRICTION is made this \_\_\_\_\_ day of \_\_\_\_\_ month \_\_\_\_\_ year  
by \_\_\_\_\_ name \_\_\_\_\_  
\_\_\_\_\_ street address \_\_\_\_\_ city/town \_\_\_\_\_  
\_\_\_\_\_ county \_\_\_\_\_ zip code \_\_\_\_\_  
(hereinafter referred to as the "Grantor", which includes the plural of the word where the  
context requires, and shall, unless the context clearly indicates otherwise, include the  
Grantor's heirs, administrators, legal representatives, devisees, successors, and assigns)  
and hereby imposes the following deed restrictions on those lots specified herein and as  
described on a plan entitled,  
\_\_\_\_\_ name of plan \_\_\_\_\_ sheets, by  
dated \_\_\_\_\_ date \_\_\_\_\_ consisting of \_\_\_\_\_ # \_\_\_\_\_  
recorded at Book # \_\_\_\_\_ survey/engineering firm \_\_\_\_\_  
Page # \_\_\_\_\_ at the \_\_\_\_\_ county \_\_\_\_\_





## Step 5 Legal Documents (LDs)

---

- Some projects may need to submit legally enforceable documents (LDs)
- WHY? To help ensure assumptions made in PLA, “NO CHANGE”, or “1065” calculations to satisfy antidegradation remain in effect in perpetuity



## Step 5 (cont)

---

### Env-Wq 1504.06 Antidegradation Plans; Deed Restrictions; Easements (to be removed from regulations for now).

- The owner is responsible for creating and recording:
  - deed restrictions to each lot that has disconnected impervious cover stating that it will remain disconnected;
  - easements or deed restrictions for each area or individual lot with UDC that is factored into the drainage calculation, stating that it will remain undisturbed in perpetuity.

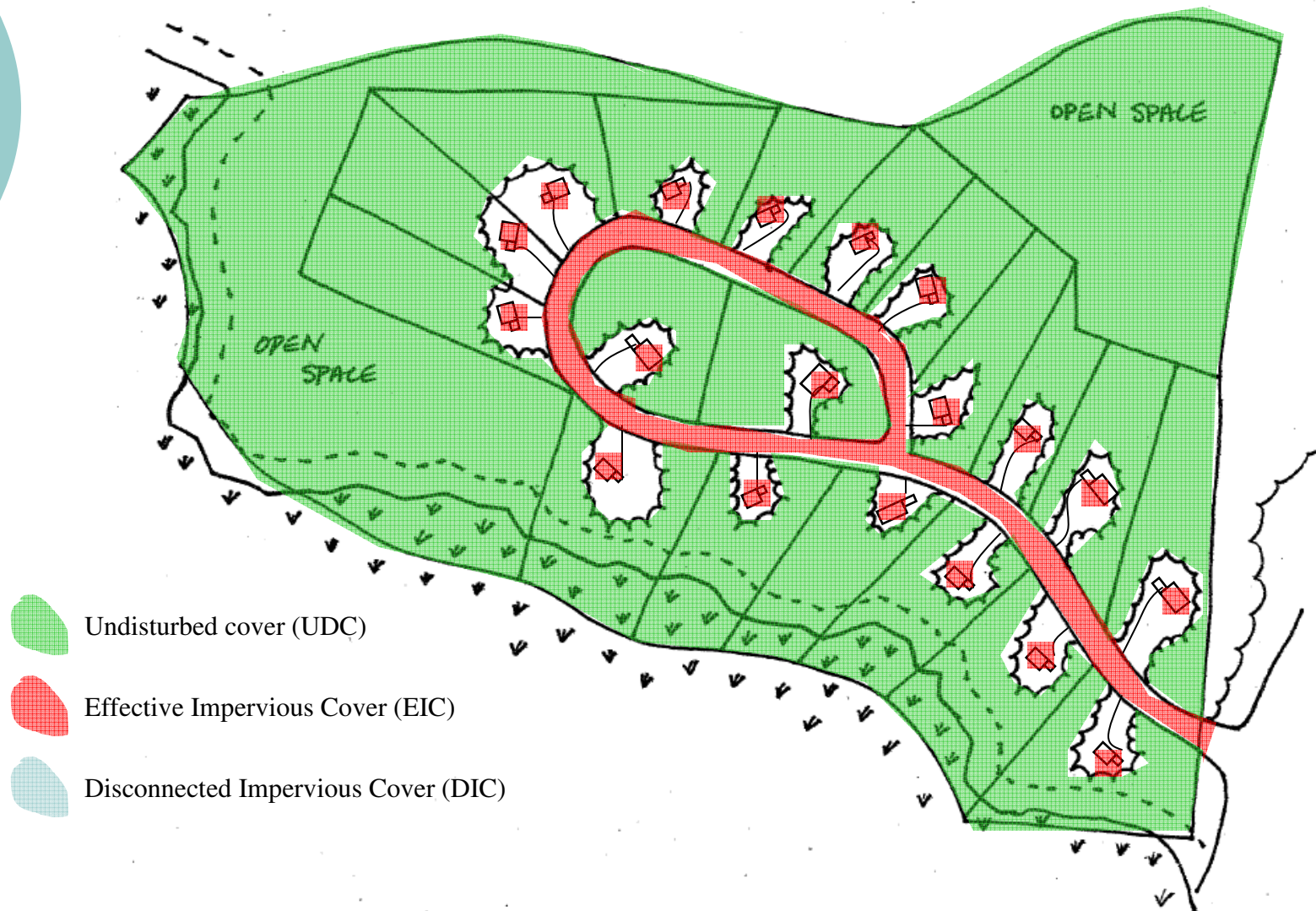


## Step 5 (cont)

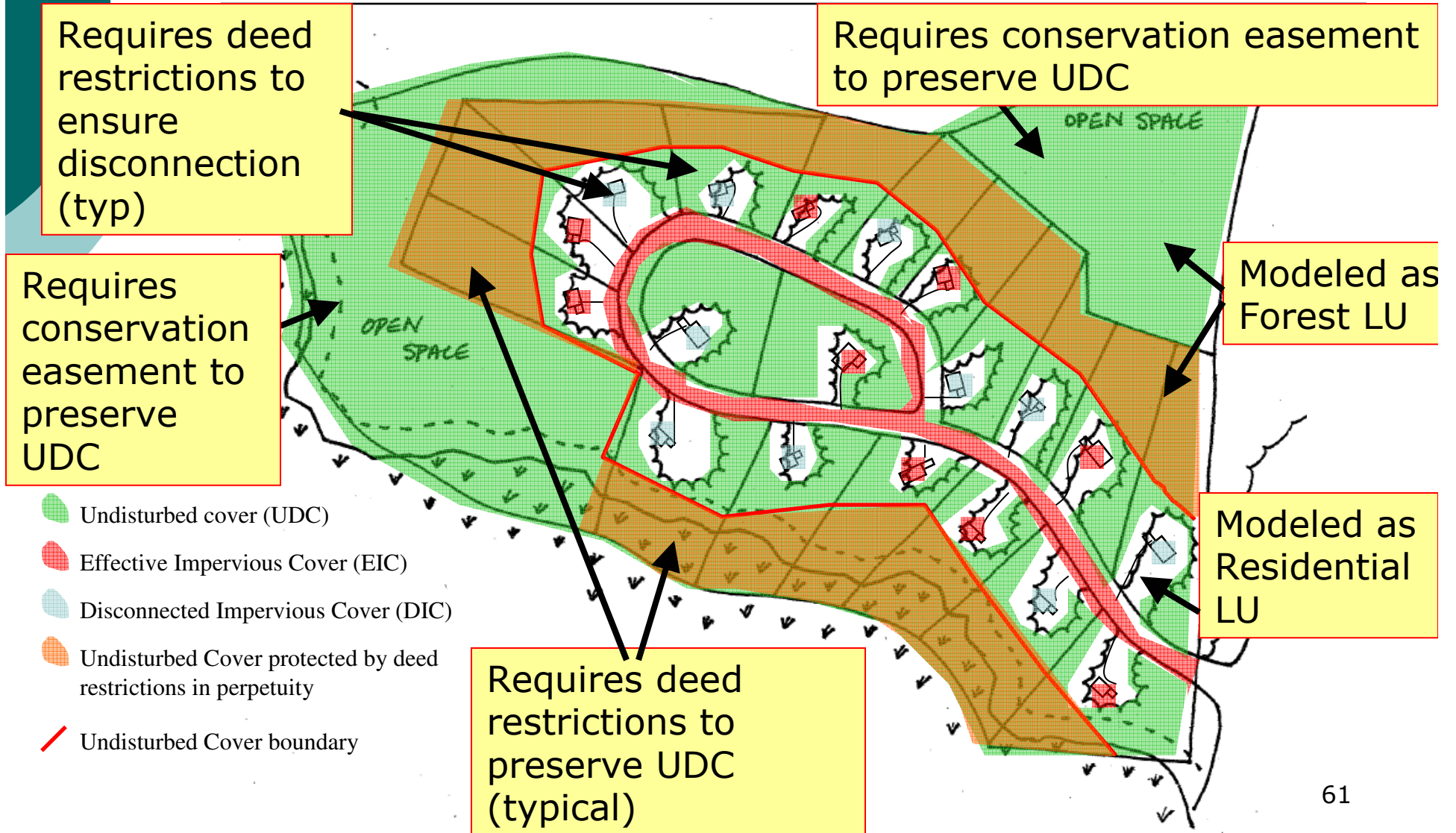
---

- Examples of when LDs are needed:
  - Area assumed to remain UDC (i.e., same as using natural land use (e.g., forested) in PLA)
  - Stormwater BMPs are on lots and lot owners are responsible for maintenance
    - Includes typical BMPs such as rain gardens, swales, etc. but also criteria used for disconnection credits (e.g., maintaining yard slope less than 5% for x feet from house and/or no significant change from grading shown on plan, maximum impervious area per lot, etc.)
  - Fertilizer with low TP and low TN is assumed

## Step 5 (cont)



## Step 5 (cont)





# QUESTIONS?

---

## Contact Information

Jillian McCarthy

271-8475

[jillian.mccarthy@des.nh.gov](mailto:jillian.mccarthy@des.nh.gov)

Gregg Comstock, PE

271-2983

[gregg.comstock@des.nh.gov](mailto:gregg.comstock@des.nh.gov)